

32°, at Newton, N. H., on the 5th. The average precipitation was 2.74, or 0.14 below normal; the greatest monthly amount, 5.51, occurred at Farmington, Me., and the least, 0.63, at South Portsmouth, R. I.—*J. W. Smith.*

New Jersey.—The mean temperature was 70.4°, or 0.7° above normal; the highest was 97°, at Beverly and Vineland on the 27th, and the lowest, 39°, at Charlotteburg on the 5th. The average precipitation was 3.08, or 0.46 below normal; the greatest monthly amount, 4.91, occurred at Asbury Park, and the least, 1.10, at Rocktown.—*E. W. McGann.*

New Mexico.—The mean temperature was 71.2°, or 1.2° above normal; the highest was 111°, at Lyons Ranch on the 27th, and the lowest, 28°, at Winsors on the 5th. The average precipitation was 1.00, or 0.09 below normal; the greatest monthly amount, 4.67, occurred at Fort Union, while at Eagle, Lordsburg, and Rincon, none was recorded, and only a trace at Alma, Hillsboro, Los Lunas, Lyons Ranch, and Olio.—*R. M. Hardinge.*

New York.—The mean temperature was 66.6°, or 0.8° above normal; the highest was 96°, at Penn Yan on the 24th and 26th, at Ticonderoga on the 28th and at Primrose on the 29th; the lowest was 25°, at South Kortright on the 9th. The average precipitation was 2.63, or 0.88 below normal; the greatest monthly amount, 5.91, occurred at Ogdensburg, and the least, 0.75, at Nunda.—*R. G. Allen.*

North Carolina.—The mean temperature was 74.4°, or normal; the highest was 99°, at Tarboro on the 13th and at Southern Pines on the 29th, and the lowest, 45°, at Linville on the 20th. The average precipitation was 6.05, or 1.69 above normal; the greatest monthly amount, 19.92, occurred at Horse Cove, and the least, 1.02, at Currituck Inlet.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 66.9°, or 3.5° above normal; the highest was 109°, at Minto on the 23d, and the lowest, 27°, at Churchs Ferry on the 8th. The average precipitation was 1.39, or 1.30 below normal; the greatest monthly amount, 3.45, occurred at Napoleon, and the least, 0.27, at Mayville.—*B. H. Bronson.*

Ohio.—The mean temperature was 69.8°, or 0.5° below normal; the highest was 96°, at Annapolis on the 24th and at Norwalk on the 26th, and the lowest, 38°, at Colebrook and Garrettsville on the 30th. The average precipitation was 2.99, or 0.42 below normal; the greatest monthly amount, 6.64, occurred at New Paris, and the least, 0.81, at Ashtabula.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 77.7°, or 0.9° above normal; the highest was 106°, at Waukomis on the 27th, and the lowest, 50°, at Newkirk on the 14th. The average precipitation was 2.58, or 0.88 below normal; the greatest monthly amount, 7.18, occurred at Osage and the least, trace, at Healdton and Pauls Valley.—*C. M. Strong.*

Oregon.—The mean temperature was 63.5°, or 3.0° above normal; the highest was 103°, at Pendleton on the 20th, and the lowest, 24°, at Riverside on the 9th. The average precipitation was 2.17, or 0.50 above normal; the greatest monthly amount, 8.65, occurred at Nehalem, while none fell at Klamath Falls.—*E. A. Beals.*

Pennsylvania.—The mean temperature was 69.9°, or 1.0° above normal; the highest was 97°, at Irwin on the 24th, at Lockhaven on the 25th and at Athens on the 28th; the lowest, 35°, at Lawrenceville on the 30th. The average precipitation was 3.60, or slightly below normal; the greatest monthly amount, 10.29, occurred at Somerset, and the least, 1.35, at Coopersburg.—*L. M. Dey.*

South Carolina.—The mean temperature was 76.2°, or 1.9 below normal; the highest was 97°, at Yemassee on the 25th and 29th, and the lowest, 52°, at Georgetown on the 1st and 21st. The average precipitation was 7.94, or 3.41 above normal; the greatest monthly amount, 15.43, occurred at Holland, and the least, 4.15, at Trenton.—*J. W. Bauer.*

South Dakota.—The mean temperature was 69.4°, or about 2.0° above normal; the highest was 109°, at Interior on the 30th, and the lowest, 28°, at St. Lawrence on the 2d. The average precipitation was 2.40, or about 1.38 below normal; the greatest monthly amount, 6.90, occurred at Gannvalley, and the least, 0.11, at Ipswich.—*S. W. Glenn.*

Tennessee.—The mean temperature was 74.1°, or 0.9 below normal; the highest was 95°, at Madison on the 10th, and the lowest, 40°, at Andersonville on the 3d. The average precipitation was 9.84, or 5.14 above normal; the greatest monthly amount, 17.93, occurred at Hohenwald, and the least, 2.26, at Bristol.—*H. C. Bate.*

Texas.—The mean temperature, determined by comparison of 45 stations distributed throughout the State, was 1.9° above the normal. Nearly normal conditions prevailed along the coast, over southwest Texas, and the panhandle, while there was a general excess over the other portions of the State, ranging from 1.0 to 4.8, with the greatest in the vicinity of Tyler. The highest was 108°, at Colorado on the 17th and at Brownwood on the 26th, and the lowest, 53°, at Amarillo on the 1st. The average precipitation, determined by comparison of 54 stations distributed throughout the State, was 1.69 below normal. There was an excess, ranging from 1.00 to 8.96, over the extreme eastern portion of the State and in the vicinity of Cuero and Henrietta, with the greatest in the vicinity of Beaumont, while there was a general deficiency over the other portions of the State, with the greatest, 4.46, at Temple. The rainfall for the month was very unevenly distributed, there being comparatively none in localities over central Texas, while heavy rains occurred over the eastern portion of the State. The greatest monthly amount, 12.70, occurred at Beaumont, while none fell at Beeville, San Marcos, and Temple.—*I. M. Cline.*

Utah.—The mean temperature was 69.7°, or 4.8° above normal; the highest was 111°, at Hite on the 28th, and the lowest, 30°, at Henefer on the 11th and at Tropic on the 15th and 16th. The average precipitation was 0.16, or 0.27 below normal; the greatest monthly amount, 1.00, occurred at Holyoake; none fell at Kelton and 6 additional stations, while a number of stations received but a trace.—*L. H. Murdoch.*

Virginia.—The mean temperature was 72.5°, or 0.5° above normal; the highest was 101°, at Doswell on the 30th, and the lowest, 42°, at Meadowdale on the 20th. The average precipitation was 4.61, or 1.83 above normal; the greatest monthly amount, 8.87, occurred at Christianburg, and the least, 0.65, at Birdsnest.—*E. A. Evans.*

Washington.—The mean temperature was 62.9°, or 3.8° above normal; the highest was 102°, at Mottingers Ranch on the 20th, and the lowest, 31°, at Republic on the 6th and at Cle-Elum, Colville, and Rosalia on the 9th. The average precipitation was 2.51, or 0.96 above normal; the greatest monthly amount, 13.92, occurred at Clearwater, and the least, trace, at Cheney.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 71.2°, or 0.9° above normal; the highest was 98°, at Oldfields on the 11th, and the lowest, 41°, at Philippi on the 1st. The average precipitation was 5.30, or 0.69 above normal; the greatest monthly amount, 15.62, occurred at Chapel, and the least, 2.49, at Southside.—*E. C. Vose.*

Wisconsin.—The mean temperature was 65.5°, or 0.8° below normal; the highest was 103°, at Medford on the 19th, and the lowest, 28°, at Barron on the 11th. The average precipitation was 2.01, or 2.33 below normal; the greatest monthly amount, 3.70, occurred at Koepenick, and the least, 0.57, at Spooner.—*W. M. Wilson.*

Wyoming.—The mean temperature was 66.0°, or 5.8° above normal; the highest was 116°, at Bittercreek on the 26th, and the lowest, 22°, at Thayne on the 10th. The average precipitation was 0.47, or 1.07 below normal; the greatest monthly amount, 1.31, occurred at Fort Laramie, and the least, trace, at Alcora, Bedford, Bittercreek, and Burlington.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

EXTENSION OF WEATHER BUREAU WORK.

By E. B. GARRIOTT, Professor of Meteorology.

A recent report on the system of hurricane warnings in the West Indies, by Mr. Wm. B. Stockman, Forecast Official in charge of the United States Weather Bureau at Havana, Cuba, suggests the following comments on recent extensions of the work of the Weather Bureau:

The West Indian branch of the United States Weather Bureau was established in the summer of 1898, as an emergency measure for providing the United States fleets and the merchant marine in West Indian waters with timely notice of approaching hurricanes. The unquestioned value of this information to the maritime and commercial interests has led to the establishment, on a permanent basis, of a service

in the West Indies, the province of which is to give warning to all interests concerned, of the approach of tropical storms of a destructive character, and to collect data and issue reports on the climate and crops of the islands of Cuba and Puerto Rico.

During the present hurricane season practically all of the cable islands and ports of the West Indies and the Caribbean coast of South America receive advices regarding tropical storms at the expense of the United States, and this information is given effective distribution, and is bulletined and exposed in conspicuous places for the benefit of the public.

The central station of the West Indian service is located at Havana, Cuba, where telegraph and cable reports of meteorological observations taken at Weather Bureau West Indian

stations are received during the hurricane season, and advices regarding disturbances are prepared for transmittal to the various islands of the West Indies. The observational data thus collected are promptly telegraphed to the Central Office of the Weather Bureau at Washington, D. C., together with warnings or advices that may have been issued.

The West Indian observation stations, which are regularly equipped and officered by the Weather Bureau, number thirteen, and provision has been made for ordering and displaying, through these stations, hurricane warnings at more than one hundred points in the West Indies. The distribution of hurricane information and advices throughout the West Indies is limited only by the telegraphic and messenger services possessed by the several islands.

During the summer of 1899 reports by telegraph were begun from well-distributed Mexican stations. These reports are furnished through the cooperation and courtesy of the Director General of the federal telegraph lines of Mexico, who delivers them (free of expense to the United States) to the official in charge of the Weather Bureau office at Galveston, Tex., who, in turn, promptly transmits them by telegraph to Washington. Credit for arranging the plan of exchange of meteorological reports between the United States and Mexico is in a large measure due to Dr. I. M. Cline, official in charge of the Weather Bureau office at Galveston.

The Central Office of the Weather Bureau at Washington now has for its consideration reports from an area which extends from the South American coast to northern Canada, a region whose extreme limits cover latitude 11° to 53° north, and longitude 60° to 125° west, or more than 42° of latitude and 65° of longitude.

The advantage afforded by this great area of telegraphic observations can scarcely be estimated. By means of the West Indian reports the tropical storms which cross the more eastern islands of that group can be detected almost in their inception. They can be traced day by day, and the probable time of their arrival at any point in their line of advance can be forecast.

By means of the Mexican Gulf coast reports the development of storms near the Yucatan and Mexican coasts can be detected, and the course of West Indian storms which cross the Gulf of Mexico can be determined. These reports furnish information which render possible warnings of the severe cold waves and northerly gales which visit the Gulf districts of Mexico during the winter months. It is believed that the reports received from northern and western parts of Mexico will lead to a better understanding of the important storms which sweep northeastward from the tropical Pacific over northern Mexico and cross the United States from the Rio Grande and southern Rocky Mountain districts to the Atlantic.

Reports from the extreme British Northwest Territory, which have been added within the last two years, have furnished valuable data regarding the movements of north Pacific storms, and will contribute to present knowledge of the mechanism of the severe cold waves which appear in that region.

The extensions referred to constitute one of the most substantial advances in the history of the Weather Bureau. The telegraphed reports afford daily and twice daily meteorological surveys of the populated parts of North America and a great part of Central America and adjacent waters, by means of which weather changes and conditions calculated to benefit or injure maritime or commercial interests can be foreseen. And it is believed that each extension of the area of observation brings nearer that desideratum of meteorologists—long range forecasts. When this area shall have been extended to even partly include the great oceanic permanent cyclones and anticyclones the science of mete-

orology will advance from a knowledge of effects to a more perfect understanding of one of the causes thereof.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological observations at Honolulu, June, 1900.

The station is at 21° 18' N., 157° 50' W.
Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.
Pressure is corrected for temperature and reduced to sea level, and the gravity correction, -0.06, has been applied.
The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force or amounts of cloudiness, connected by a dash, indicate change from one to the other.
The rainfall for twenty-four hours has always been measured at 9 a. m. local or 7:31 p. m. (not 1 p. m.), Greenwich time, on the respective dates.
The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.		Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 2:30 a. m., Honolulu time.							Total rainfall at 9 a. m. local time.	
	Dry bulb.	Wet bulb.	Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.			
			Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.		
1.....	29.96	73	68.5	83	74	64.5	71	ne.	3	3	30.01	29.95	0.05
2.....	29.97	73	67.5	82	72	66.0	67	ne.	4	3	30.00	29.94	0.03
3.....	29.97	69	67.5	83	72	65.0	67	ne.	4-1	5	30.03	29.94	0.08
4.....	30.00	67	64	83	68	65.3	72	ene.	1-5	5-2	30.03	29.95	0.00
5.....	29.99	68	66	83	67	64.7	70	ne.	3	3	30.05	29.98	0.00
6.....	30.00	74	69	85	67	67.7	78	sw-n.	2-4	1-4	30.04	29.97	0.00
7.....	29.99	74	67.5	85	72	66.8	68	ne.	3	1	30.04	29.96	0.00
8.....	30.00	75	69	85	69	64.5	65	ne-nne.	3	1	30.04	29.95	0.00
9.....	30.03	72	67	85	73	64.7	68	ne.	3	2-5	30.06	30.00	0.00
10.....	29.97	67	64.5	84	72	64.0	66	ne.	4-1	3-1	30.05	29.96	0.00
11.....	29.94	71	67	85	67	62.3	65	nne.	3-0	1-0	30.01	29.94	0.00
12.....	29.91	71	69	86	69	67.0	72	ne.	2-0	4	29.97	29.88	0.05
13.....	29.87	74	70.5	82	70	68.0	78	ne.	3	5	29.92	29.86	0.00
14.....	29.92	75	69	85	72	67.7	71	ene.	3	5	29.94	29.86	0.00
15.....	29.94	76	68.5	86	74	65.5	64	nne.	3-4	1-4	29.98	29.90	0.00
16.....	29.98	75	68.5	85	75	66.0	65	ne.	4	2-5	30.01	29.96	0.06
17.....	29.98	77	70.5	85	74	65.5	64	ene.	4	3	30.01	29.96	0.01
18.....	30.00	76	69	86	76	67.0	65	ne.	3	3	30.02	29.95	0.01
19.....	30.03	72	67	86	73	63.7	60	nne.	3	1-0	30.06	29.98	0.00
20.....	30.03	75	68	86	70	63.5	62	ne.	3	3-1	30.08	30.02	0.00
21.....	30.05	76	68.5	85	70	64.3	62	ne.	3	3	30.07	30.00	0.00
22.....	30.02	75	69.5	86	75	65.5	63	ne.	3	3-6	30.09	29.99	0.00
23.....	30.01	75	72.5	88	75	67.3	66	ne.	2	1-4	30.07	29.99	0.04
24.....	30.02	77	69.5	84	75	70.3	78	ne.	2	5	30.07	30.00	0.00
25.....	30.02	74	70	86	75	65.7	74	ne.	2	1	30.07	29.99	0.04
26.....	29.99	76	68	85	73	68.0	73	nne.	1-3-0	3-1-7	30.05	29.98	0.03
27.....	29.98	75	70.5	85	72	65.7	67	ne.	2-5	3	30.04	29.98	0.40
28.....	29.97	76	70	82	72	68.3	76	ne.	2-4	7-3	30.02	29.96	0.05
29.....	29.97	77	70	84	75	68.0	73	ne.	4	3	30.01	29.94	0.01
30.....	29.99	77	70	85	77	67.0	65	ne.	3.5	3	30.03	29.96	0.02
Sums.....													0.88
Means.	29.983	73.7	68.3	84.7	72.2	66.0	68.0	3.0	3.1	30.029	29.956
Departure..	-0.02					+0.5	-2.6				-0.9		-0.72

Mean temperature for June, 1900 (6+2+9)+8=77.6°; normal is 75.9°. Mean pressure for June (9+8)+2 is 29.991; normal is 30.012.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)+4. §Beaufort scale.

RAINFALL AND DRAINAGE IN THE UPPER CHAGRES RIVER.

By GEN. HENRY L. ABBOT, dated July 10, 1900.

During the past year the matter of rainfall and drainage on the Isthmus of Panama has received special study. The following results are translated from my original paper compiled for the Compagnie Nouvelle and are communicated to the MONTHLY WEATHER REVIEW as being of general interest.